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Water quality of the plain of El-Hadjar wilaya of Annaba (Northeast Algeria)

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Abstract

The region of El- Hadjar is known for its diversity of industries that stretch of the steel industry to the food and materials processing. Industrial and domestic waste is channeled into streams Oued Seybouse is its major tributary Oued Meboudja, both flanked with major industrial areas. Pollution of surface and groundwater has become a particular problem of interest for health and environmental conservation. This study aims to physico- chemical characterization of waters in this area using 11 sampling points covering the entire area of a spread on rivers and plains of El Hajar). The results are expressed in terms of concentrations of the various pollutants such as nitrate, nitrite and chloride in a first step. The physico -chemical parameters were recorded over a period of seven months during 2009 and relate to salinity, conductivity, pH, Eh ... It was found that the region is moderately polluted following the accepted standards. The data are correlated with industrial and agricultural activity in the region. The study is in the process of being completed by a water quality map of the entire region with the concentrations of hydrocarbons and heavy metals. The evolution of these parameters will develop a policy for the preservation of the environment that is needed in these times.

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1. Introduction

A water mass is a hydrographic unit (surface water) and hydrogeologic (groundwater) coherent, showing rather

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homogeneous characteristics and for which, one can define the same objective. The good state of these water masses was destroyed by pollution. In the industrialized countries, vast programs made it possible to slow down the progression of the contamination of continental water, even sometimes to make it regress. This contamination is due to the rejections of effluents domestic and industrialists charged with fermentable organic matters. To oppose it, chemical pollution progressed, in particular, those due to toxic metals, fertilizers and the pesticides.[1,2,3] This pollution relates to more and more not only surface waters but the water tables. At the present time, in Algeria, the large rivers and their affluents, just as certain water tables are polluted in a chronic and permanent way. They are even contaminated at the point to be unsuitable with the domestic, industrial uses even agricultural.
The vulnerability of the aquiferous systems located near the urban centres is materialized by a contamination in the shape of affluents which are thrown in the waterways. As there is a mixed relation between surface water and groundwaters, The area of El-Hadjar (wilaya of Annaba) is a perfect example on the water pollution. This worrying situation always made; object of several studies among which Nafaa (1985), Hannouche (1990), Kherici (1993), Djabri (1996), Louhi (1996), Zenati (1999), Debieche (2002), Hani (2003) Derradji (2004), Khalfaoui and Medjani (2005), Hamzaoui (2007)… etc. A preliminary physicochemical study of the water supply points taken on the level of the tablecloth and the two wadis Seybouse and Meboudja showed the possibility of one vulnerability to the water pollution of the water table by the infiltrations of water of the wadis and waste waters [4,5,6].

2. Vulnerability has pollution

Vulnerability of the groundwater tablecloths is indeed fragile and the position risk is as much more frightening it is slow to take effect, through the ground to the unsaturated zone. Thus, some is the nature of physical pollution (radioactivity), chemical (mineral pollutants) and, organics (pesticides, solvents various) and or bacteriological: the bacteria, viruses, the aquifers are very time touched.

However the prevention against the pollution of the tablecloths constitutes a big step, to which the scientists agree more and more of efforts, in particular by studying the vulnerability of the underground layers, within this framework they created classical and digital scientific methods, to facilitate the identification of the state of these tablecloths and to control the evolution of the pollutant in the water tanks such as methods (DRASTIC, GOD, IF, SINTACS…).

3. Material and methods

Work consists in evaluating the vulnerability and the position risk of a certain number of water supply points, representing the area of Annaba (Fg.1.). The takings away were carried out on water of drillings and domestic wells for one period of more than 25 years and were supplemented by current analyses. The spectrophotometer of atomic absorption to flame was used for the analysis of heavy metals, and the Spectrophotometer of atomic absorption (PU8620 Philips) for the nutrients (NO_3, NO_2). For the proportioning of the DBO_5 (biochemical demand for oxygen), a DBO measures was used.

The treatment of the chemical analyses used is based on a new method of determination of the vulnerability and position risk of water [7, 8, 9 and 10]. It is represented by an abacus supported on natural factors (thickness of the unsaturated zone, geological facies, degree of self-purification) and on the causes of vulnerability of the tablecloths to pollution (factors anthropic caused by the man).

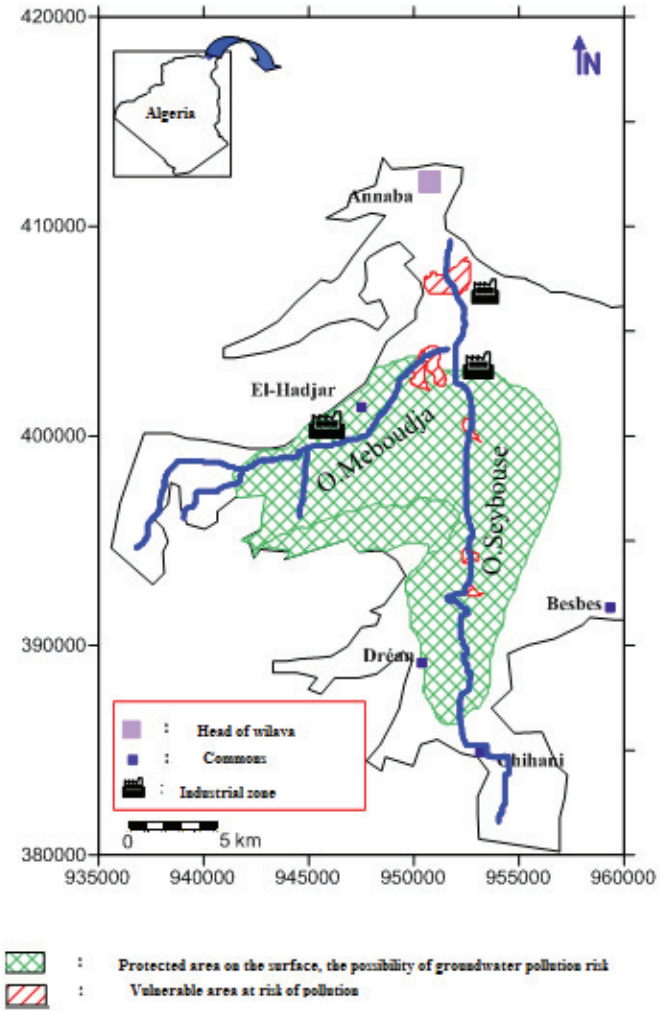


Fig. 1 Map of vulnerability and position risk of the surface tablecloth in the area of Annaba.

In this tablecloth there exist two types of states of vulnerability (Fig. 1) and risk to pollution.

1. The vulnerable ground with position risk, occupies the zone coloured in red. The lithology of this ground is primarily made of sablo-argillaceous layers with a power car purifier of the ground on the vertical way Mandelevium lower than 1, bound especially to the level piezometric near to the surface of the ground < 1m). The index of mineral contamination (ICM) is very high of about 6.
2. The green which occupies almost all the plain of El-Hadjar, indicates a protected ground surfaces some with the possibility of position risk of groundwaters. Lithology is almost the same one, where the value of the purifying power of the ground on the vertical way Mandelevium is higher than 1. On the other hand the values of the index of mineral contamination (ICM) and organics (ICO) are high.

4. Results and discussion

The samples are taken during the periods of the months: March, April and May 2009 in order to make a realistic description and a follow-up of pollution which took place in the area. As the direction of flow in the Wadis takes a saigneux way of the upstream (Meboudja Wadi) towards the downstream (Seybouse Wadi). The figures indicate the variation of the concentrations of the pollutants in space and time.

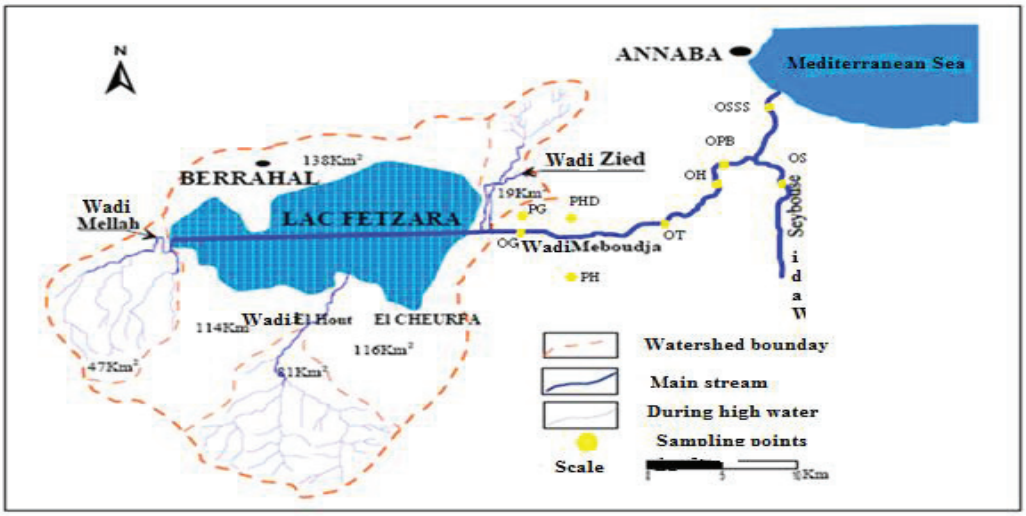
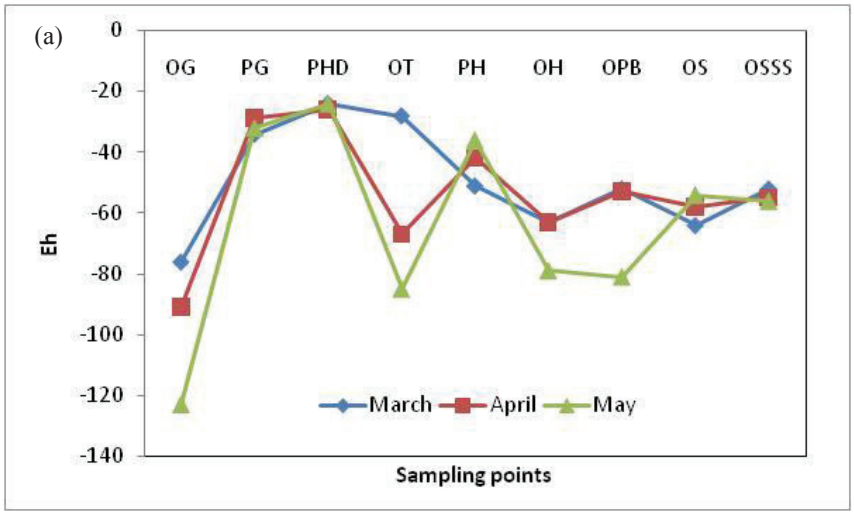


Fig. 2 Map of the hydrographic network of the area study and of the intake points

Concerning the physical parameters which are related to the domestic and industrial wastes indicating a reducing medium (- 28 to -123); (Fig. 3 (a)) and acid (pH between 7 and 9); (Fig. 3 (b)). The values of conductivity are upstream high like downstream because of the saliferous contributions of the Lake Fetzara and with the marine intrusions. While the concentrations of the chemical elements in water have sometimes a specific variation.



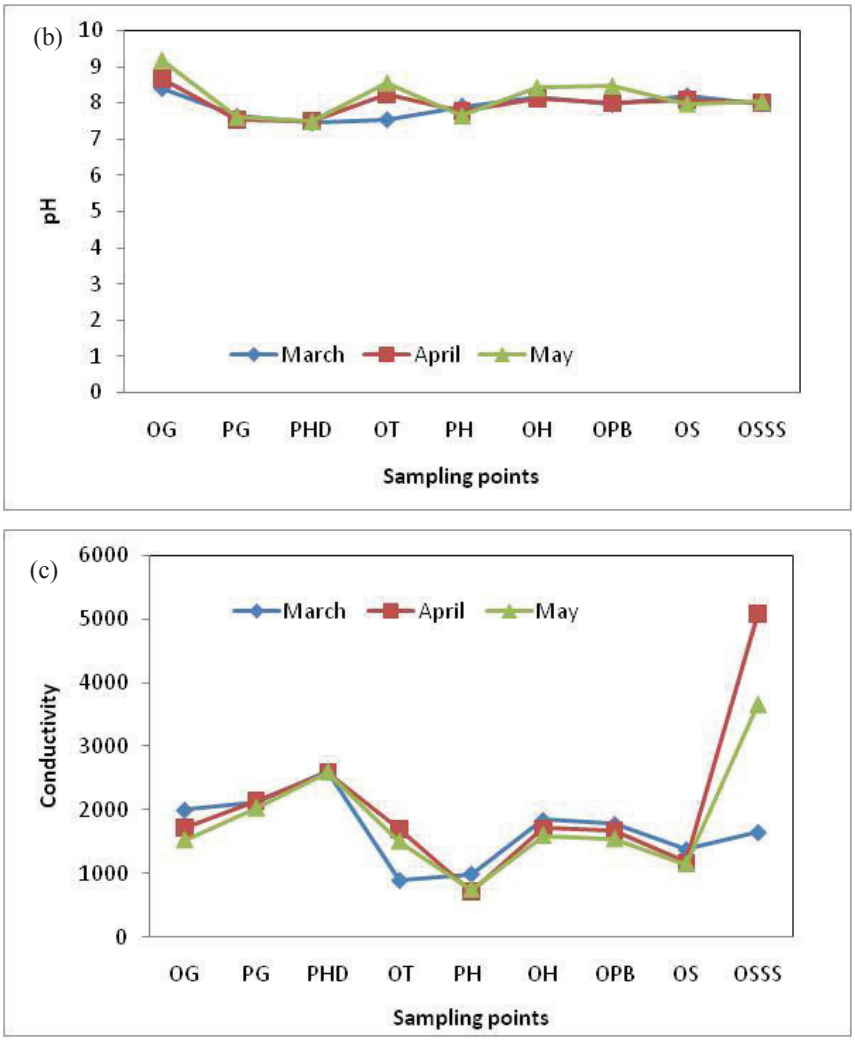
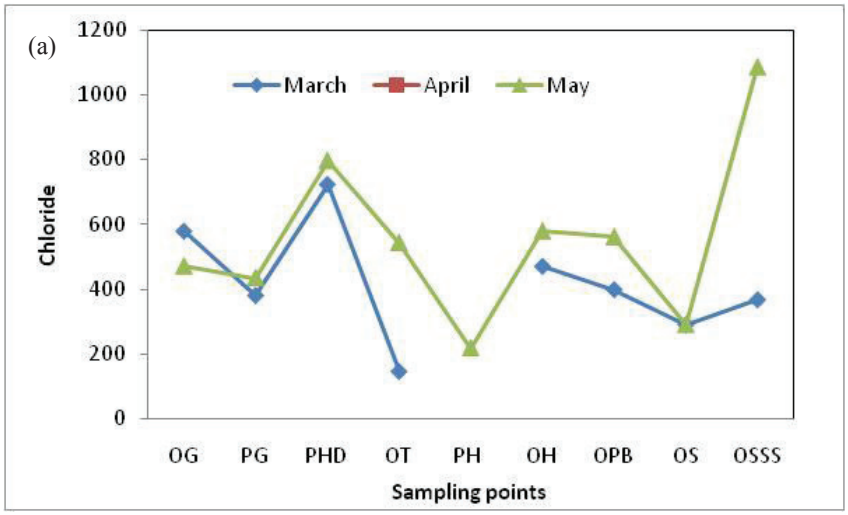
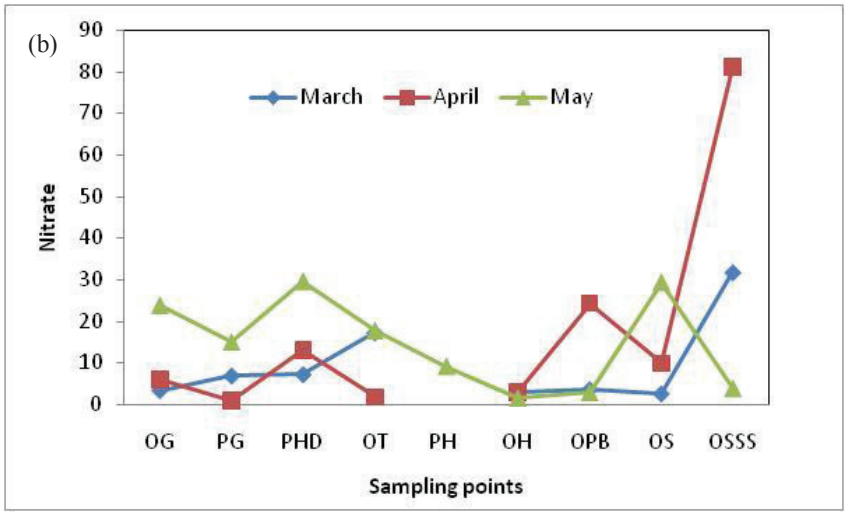
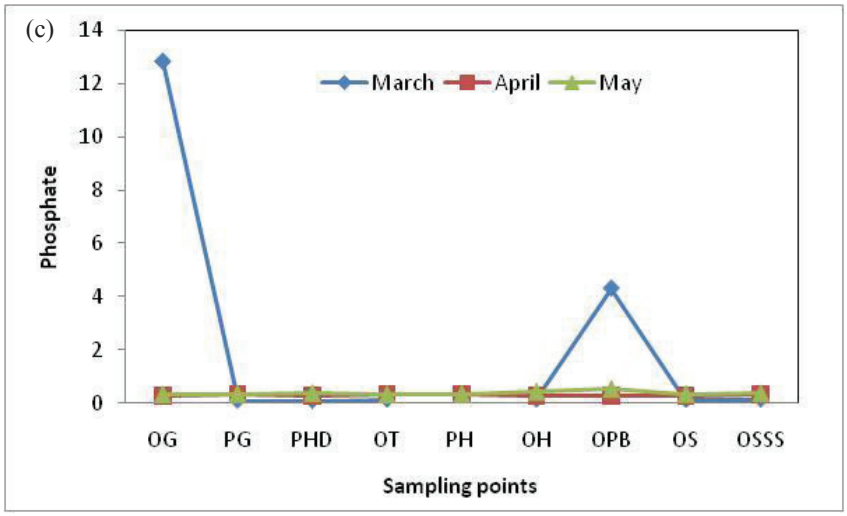


Fig. 3 Variations of the : a) Eh, b) pH, c) conductivity in the Meboudja Wadis and Seybouse of the upstream towards the downstream and in the plain of El-Hadjar (Mars, April and May 2009).

The Cl contents exceed the standards in the majority of the wells (200 mg/l) which is due to the dissolution of the saliferous formations rich in halite (PHD: 795.56 mg/l), in the same way on the level of surface waters, their concentrations are related to the saliferous contributions of the Lake Fetzara (OG: 578.59 mg/l) and increase of marine water in the Wadi Seybouse (OSSS: 1084.86 mg/l). The results show that the origin of Phosphates and the Nitrates (Fig. 4 (b,c)) would be related to the domestic rejections and with the dissolution of the chemical fertilisers, more the share of the contents are lower than the standards (it is high in surface waters that in groundwaters). The monthly follow-up of Fe, Cu and Zn made it possible to note a space and temporal evolution. Concerning the Iron concentrations their origin can be due to geology by scrubbing of the argillaceous formations, or to industry (metallurgy and iron and steel industry) (PHD: 2,07mg/l). Contents obtained for copper, iron and zinc (Fig. 4 (d,e) are weak for 2 water (surface and underground).


(a)
1200
1000
800
600
400
200
0
Chloride
March
April
May
OG
PG
PHD
OT
PH
OH
OPB
OS
OSSS
Sampling points


(b)
90
80
70
60
50
40
30
20
10
0
Nitrate
March
April
May
OG
PG
PHD
OT
PH
OH
OPB
OS
OSSS
Sampling points


(c)
14
12
10
8
6
4
2
0
Phosphate
March
April
May
OG
PG
PHD
OT
PH
OH
OPB
OS
OSSS
Sampling points

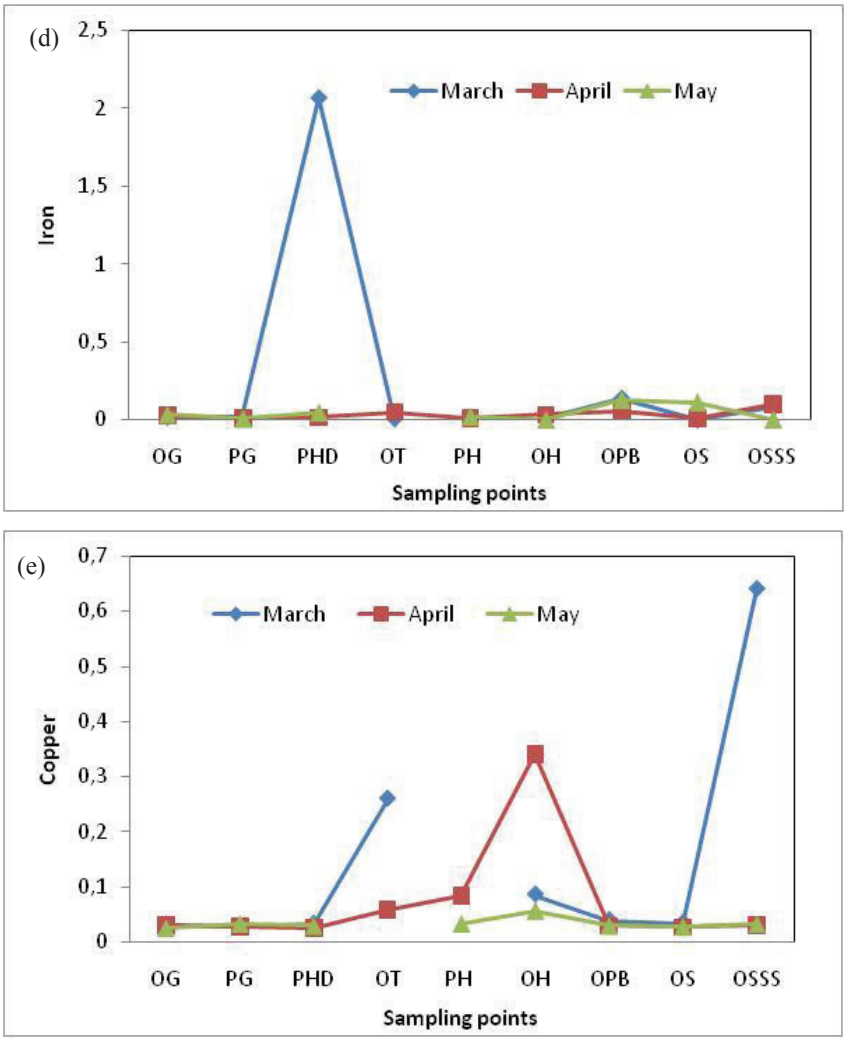


Fig.4 Variation of the elements chemical and heavy metals in the two Meboudja Wadis and Seybouse of the upstream towards the downstream and the plain of El-Hadjar (Mars, April and May 2009).

5. CONCLUSION

The objective of this work is to evaluate the degree of surface and underground pollution waters of the industrial area of El-Hadjar. The results of characterization of the selected intake points show that, for the majority of the analyzed parameters (Cl: 740.10 mg/l, P: 12.84 mg/l, Cu: 0.64 mg/l), the water pollution is obvious and the standard is often exceeded. Complementary studies on the analysis of the grounds and hydrocarbons in progress confirm this pollution also more.

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Nomenclature

OG	Wadi Meboudja (vane bridge)
PG	Well at the valve bridge
PHD	Well in the village of hdjar Ediss
OT	Wadi Meboudja (village etarf)
PH	Well in the village of El houraicha
OH	Wadi Meboudja (village El houraicha)
OPB	Wadi Meboudja at bouchet bridge
OS	Wadi Seybouse at the village of El hadjar
OSSS	Wadi Seybouse at the village of Sidi salem